

THE CARBON DIOXIDE GAME

Adapted from The Government of Western Australia's Department of Environment and Conservation's AirWatch Breathe Easy "Climate Change Education Package"

Overview: This is an active lesson that will help explain the greenhouse effect and human contribution to global climate change. The game can be played with groups of up to 30 students

Objectives:

- To demonstrate the greenhouse effect by showing how CO₂ in the atmosphere traps heat and insulates the Earth.
- To show that human activities affect the concentration of greenhouse gasses in the atmosphere.

Time: 20 minutes, including time for debriefing

Suggested Grade Level: 3 – 7

Materials: An open area, chalk, a small bag with the words "What did humans do?" written on it, and action cards representing human actions that affect CO₂ levels in the atmosphere (see examples and add more as needed)

PROCEDURE

1. Draw two concentric circles on the ground, one about a foot and a half in diameter, and a larger one about 15 feet in diameter. The smaller circle represents the Earth, and the larger one represents Earth's atmosphere.
2. The game is played in several rounds. For ROUND ONE, choose two students to be CO₂ molecules, and place them anywhere in Earth's "atmosphere." Once they are in the atmosphere they can not move their feet. The rest of the students are sunbeams representing energy from the sun.
3. The object of the game is for the sunbeams to enter the atmosphere, tag the Earth (by touching the inner circle with a foot or hand) and then escape the atmosphere without getting tagged by a "CO₂ molecule." Sunbeams who are tagged must stay standing still in the atmosphere. Those who avoid being tagged bounce back out of the atmosphere into space. Each round lasts approximately 30 seconds and during that time the sunbeams try to tag the Earth only once.

This simulation represents the greenhouse effect: energy from the sun is trapped as heat by CO₂ and other gases and particles in the atmosphere.

4. After the first round, have the escaped sunbeams form a circle around the atmosphere to check how much energy has been trapped. Discuss how this may affect the temperature of the planet. Remind students that a certain amount of CO₂ is necessary to keep the planet consistently warm enough to support life.

During the first round, most of the energy will have escaped because CO₂ levels are low. Before continuing the game, clear all the trapped sunbeams out of the atmosphere.

5. ROUND TWO: increase the number of CO₂ molecules in the atmosphere. Do this by reaching into the "What did humans do?" bag and pulling out an action card (*for this round, include only cards that add CO₂ to the atmosphere.) After a student reads the card, increase the number of CO₂ molecules in the game (dictated by the card) and play again.
6. ROUND THREE (and subsequent rounds): Put all of the action cards in the bag so that CO₂ levels will go up and down depending upon which card is drawn. Discuss what happens each time.

The game will demonstrate that when you increase the amount of CO₂, more heat gets trapped (illustrated by the student sunbeams standing in the atmosphere) and the Earth warms up. The action cards demonstrate how even small-scale actions can decrease the amount of greenhouse gases that we emit into the atmosphere.

DISCUSSION

- Review how energy from the sun gets trapped in the Earth's atmosphere
- Discuss how human actions, particularly burning fossil fuels, can enhance the greenhouse effect by putting more CO₂ into the atmosphere.

EXTENSIONS

- The game can be a springboard into a variety of other explorations such as researching alternative energy sources, discussing sustainable lifestyles, and examining the different choices humans can make in relation to the environment.

ACTION CARDS – “Things Humans Do”

<p>HUMANS DRIVE CARS (+2)</p> <p>Every gallon of gas burned in a car puts about 20 pounds of CO₂ into the Earth’s atmosphere. ADD TWO CO₂ MOLECULES</p>	<p>HUMANS RIDE BIKES (-2)</p> <p>Riding a bike is the most energy efficient form of transportation. And it’s fun! REMOVE TWO CO₂ MOLECULES</p>
<p>HUMANS DRIVE MORE CARS (+2)</p> <p>In 1908 Ford build the model T car. Between 1908 and 1928, 15 million were sold. Today an estimated 500 million cars are in use worldwide ADD TWO CO₂ MOLECULES</p>	<p>HUMANS PLANT TREES (-4)</p> <p>Trees remove CO₂ from the atmosphere during the process of photosynthesis. REMOVE FOUR CO₂ MOLECULES</p>
<p>HUMANS CUT DOWN TREES (+4)</p> <p>Trees remove CO₂ from the atmosphere during photosynthesis. Fewer trees mean more CO₂. ADD FOUR CO₂ MOLECULES</p>	<p>HUMANS USE EFFICIENT TECHNOLOGIES (-4)</p> <p>Compact fluorescent bulbs are about four times more efficient than incandescent bulbs. REMOVE FOUR CO₂ MOLECULES</p>
<p>HUMANS BURN TRASH (+2)</p> <p>Burning waste puts CO₂ into the atmosphere along with other pollutants. ADD TWO CO₂ MOLECULES</p>	<p>HUMANS RECYCLE (-2)</p> <p>Recycling saves energy and lets us reuse materials. REMOVE TWO CO₂ MOLECULES</p>
<p>HUMANS BURN COAL TO MAKE ELECTRICITY (+6)</p> <p>The burning of fossil fuels is the largest contributor to climate change. ADD SIX CO₂ MOLECULES</p>	<p>HUMANS USE ALTERNATIVE ENERGY SOURCES (-6)</p> <p>Alternative energy resources such as wind, solar, and hydroelectric produce energy without releasing CO₂. REMOVE SIX CO₂ MOLECULES</p>